

**THE EMBIOPTERA OR WEB-SPINNERS OF
WESTERN AUSTRALIA.**

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(With three Text-figures.)

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The Order Embioptera, or Web-spinners, is a small but very distinct and isolated group of insects, which represents, at the present day, a much reduced remnant of the great complex of insect types which are known as the Protorthoptera, and which existed in the Palæozoic Age. In the Upper Carboniferous these were chiefly insects of large or moderate size, with complex and reticulated venation. In the Lower Permian, owing to dry, torrid conditions, they show signs of reduction and simplification; the ancestors of the Web-spinners and other groups, such as the Earwigs or Dermaptera, can be detected there. After that, the fossil record of these insects is lost, owing to the extreme delicacy of the reduced wing-type; and we do not pick them up again until they appear, in the Baltic Amber of the Oligocene, as true Web-spinners, closely resembling those of the present day, and belonging to the same genera.

This small Order is divided into two families, viz., the Embiidae, in which R_{4+5} (or more rarely R_{2+3}) is forked either in both wings, or at any rate in the hindwing, and the Oligotomidae, in which both branches of Rs are simple in both wings. No representatives of the Embiidae have yet been found in Australia; a rather curious fact, as this family is undoubtedly more archaic than the Oligotomidae.

Only a single species of the family Oligotomidae has so far been recorded from W.A. This is *Oligotoma hardyi* Friedrichs, which occurs in and around Perth. By the kindness of Mr. L. Glauert, Acting Assistant in charge of the Biological Collections in the W.A. Museum, Perth, I have received for examination a number of specimens of a second very distinct species from Milly Milly Station, Murchison River, lat. 26° S., long. 117° E. Mr.

Glauert has also sent me specimens of *O. hardyi* Fried. in alcohol, for comparison with the new species. The study of these specimens enables me to point out some inaccuracies in Dr. Friedrichs' original description of *O. hardyi*—mistakes which were unavoidable owing to the drying up of the parts in the dead insect. These are corrected in this paper. The new species is here dedicated to Mr. Glauert, through whose kindness and interest in these out-of-the-way insects I have been enabled to study these specimens.

In describing Embioptera, it should be borne in mind that the males are always winged, and frequently come to light, while the females are always wingless, and are only found in their webs, or running about under rocks, etc., on the ground. The species of an extensive genus like *Oligotoma*, which is circum-tropical, can only be clearly separated on the terminal appendages of the male, though the wing-venation is also an aid, as in the present case. Thus it will be seen that it is inadvisable to attempt any diagnosis of species on characters of the female only; in this respect we are fortunate, as the specimens of both species sent to me consist entirely of males. For study of the appendages, the shrivelled end of the abdomen should be cut off and left to macerate in a solution of 10 % KOH for 24 hours or so. At the end of that time, it should be well washed in water, and either mounted in glycerine jelly, or else in Canada Balsam after dehydration in alcohol. The former mounts are the better, to my mind, as these rather soft appendages tend to harden and shrivel slightly after a time, if they have been passed through clove oil.

In order to understand the description of the appendages (Text fig. 2), it must be remembered that the Embioptera are remarkable in having the tenth tergite and the cerci of the male modified *asymmetrically* to serve as clasping organs during pairing. A process (*sp.*) attached to the ninth sternite, or developed in close relationship with it, is the true copulatory organ, or penis; above this, there are the two cerci (*lc, rc*), each of which consists of two segments, the right cercus remaining of normal form, while the left is modified in various ways, according to the species. Above the cerci lie the two halves of the tenth tergite, originally a single sclerite which has become secondarily and asymmetrically divided, and with a backwardly directed process developed from each half (*lp, rp*); of these processes, that from the right half (*rp*) is always the most prominent, standing out freely from the right cercus, while that of the left (*lp*) is frequently more or less engaged with a process or outgrowth of the basal plate on which the left cercus is carried. These parts are all named in Text-fig. 2.

The genus *Oligotoma* is the sole known genus in the family Oligotomidae. It can therefore be recognised at once, as far as the males are concerned, by the fact that the radial sector, *Rs*, has only

two branches, in both fore and hind wings. Text-fig. 1 shows the forewings of the two Western Australian species; they will be seen to differ only in size, in the arrangement of the cross-veins, and in the formation of the end of the radius, R_1 . The veins themselves, with the exception of the strongly formed radius, are always either exceedingly fine or entirely obsolete; but their courses are clearly marked out by bands of brown pigment, between which there are paler or unpigmented areas carrying a number of special tactile hairs or macrotrichia (omitted in the figures).

Family OLIGOTOMIDAE.

Genus OLIGOTOMA Westwood, 1837.

Oligotoma hardyi Friedrichs.

(Text-figs. 1, 2, a.)

Friedrichs, K., Records of the W.A. Museum, 1914, vol. I., part 3, p. 241.

Dr. Friedrichs' description of the male is on the whole an excellent one, but it suffers from the fact that he had only the dried material to work upon. Dr. Friedrichs remarked that the species differed from both Enderlein's and Krauss's diagnosis of the genus *Oligotoma*, yet it was an undoubted member of that genus. He states that it differs from Enderlein's diagnosis in "the strong development of the median and the posterior branches of the radial ramus (*i.e.* Rs), and in the absence of a process on the left half of the tenth tergite." The stronger development of Rs and M is certainly a fact, and serves to separate the species from other members of the genus. It appears to me to be correlated with the somewhat larger size and stronger build of this insect. Usually in this genus the vein R_{4+5} is only partially developed, while M is generally only represented by its pigment band. But as regards the process of the left half of the tenth tergite, maceration of the appendages in KOH solution shows that this is certainly present (Text-fig. 2, a, *lp*); it is possible that Dr. Friedrichs mistook this process, if it was visible in the dried specimen, for part of the penis or process of the ninth sternite (*sp*), which he describes as apparently bifid. He also states that the species differs from Krauss's diagnosis of the genus "in possessing teeth on the much-thickened first joint of the left cercus." In the macerated specimen (Text-fig. 2, a) this part (*lc.*) is certainly thickened, but the inwardly produced portion is not toothed, as he says it is, but is only furnished with a series of stiff, short bristles. In the dried specimen, no doubt, the rather swollen bases of insertion of these bristles gave the appearance of a toothed margin.

Text-fig. 2, *a* also shows the true shapes of the two halves of the tenth tergite, which differ considerably from Dr. Friedrichs' description of them. The left half is the smaller of the two, and is sub-triangular in form; its process is attached to its inner angle by a very narrow base. The right half is also subtriangular, and much larger than the left; its process is merely a slight prolongation of its posterior angle, strongly chitinized apically, and with its apex slightly notched, as shown in Text-fig. 2, *a*, *rp*.

Text-fig. 1, *a* shows the forewing, in which it should be noted that R_1 does not bend strongly down to fuse with R_s , as in many species of this genus. The basal radio-median cross-vein (*r-m*) is placed quite transversely and is strongly developed. The number of cross-veins is exceptionally large, there being generally six between the costa and R_1 , along the distal half of the wing, five or six between R_1 and the upper branch of R_s , two or three between the two branches of R_s , and two also between R_{4+5} and M . The last two series are rather weakly developed.

Measurements of forewing of the specimen figured are 11 mm. long by 2.6 mm. wide; of the hindwing, 9.2 mm. long by 2.1 mm. wide.

Female unknown.

Type: Holotype and paratype male in Coll. W.A. Museum.

Habitat: The types were captured at light in Perth. The specimens sent to me by Mr. Glauert were taken at Caversham, near Perth, but Master C. Kerruish, in 1915.

Oligotoma Glauerti, n. sp.

(Text-figs. 1, 2, *b*.)

Male: Total length 10 mm., forewing 9 mm., hindwing 8 mm.

General colour medium brown; legs and cerci brownish testaceous.

Head oval, with the *eyes* slightly projecting antero-laterally. *Antennae* pale brownish, 7.5 mm. long, with 21 segments, the first somewhat swollen, half as long again as the second, which is closely united with the third; third and fourth of equal length, each nearly twice as long as the second (Text-fig. 3, *b*). (In *O. hardyi*, the basal segment is much more swollen, and the third is nearly twice as long as the fourth; see Text-fig. 3, *a*). *Mandibles* at bases only as wide as, or a little wider than across the middle; right mandible with two apical teeth, the left with three; the right with a rounded projection on middle of inner margin, the left with a similar projection excavated in its middle. (Text-fig. 3, *b*). (In *O. hardyi*, the mandibles are much wider basally than across middle, the apical teeth larger, and the inner projections less prominent and closer to the teeth; see Text-fig. 3, *a*). *Palpi* pale brownish.

Thorax and legs of normal form, the fore tibiae only moderately swollen.

Wings subhyaline with pale brownish pigment bands; R_1 dark brown. R_{2+3} complete, but R_{4+5} only represented by a short basal piece and complete pigment band. M and anterior branch of Cu only represented by pigment bands; straight stem of Cu present as a true vein. Basal radio-median cross-vein present, oblique. No true cross-veins between costa and R_1 ; from three to five cross-veins between R_1 and Rs; none between the two branches of Rs, and none between R_{4+5} and M.

Abdomen of normal form for the genus. Appendages as shown in Text-fig. 2, *b*; the right half of the tenth tergite narrower than the left basally, divided distally into two projections, the inner of which is finger-shaped, not strongly chitinised, the other (*rp*) very strongly chitinised, narrowly cylindrical, with its apex truncated and slightly excavated; left half of tenth tergite with a projecting piece (*lp*) carrying a strongly chitinised hook, which clasps the inwardly projecting end of the basal plate of the left cercus near its pointed end. Ninth sternite with a very slender, sharply pointed process (*sp*). Right cercus normal, the second segment (rc_2) slightly longer and narrower than the first (rc_1). Left cercus with the distal portion of the first segment strongly produced inwards into a transverse lobe (lc_1) reaching almost to the middle line; second segment (lc_2) almost normal, very similar to that of right cercus, but a little longer and slightly curved.

The form of the chitinised process of the right half of the tenth tergite, and the shape of the left cercus, at once distinguish this species very sharply from *O. hardyi*, Fried. The shape of the first segment of the left cercus also serves to distinguish it clearly from all other known species of *Oligotoma*.

Female unknown.

Types.—Holotype male and one paratype male in Coll. W.A. Museum; two other paratype males in Cawthron Institute Collection.

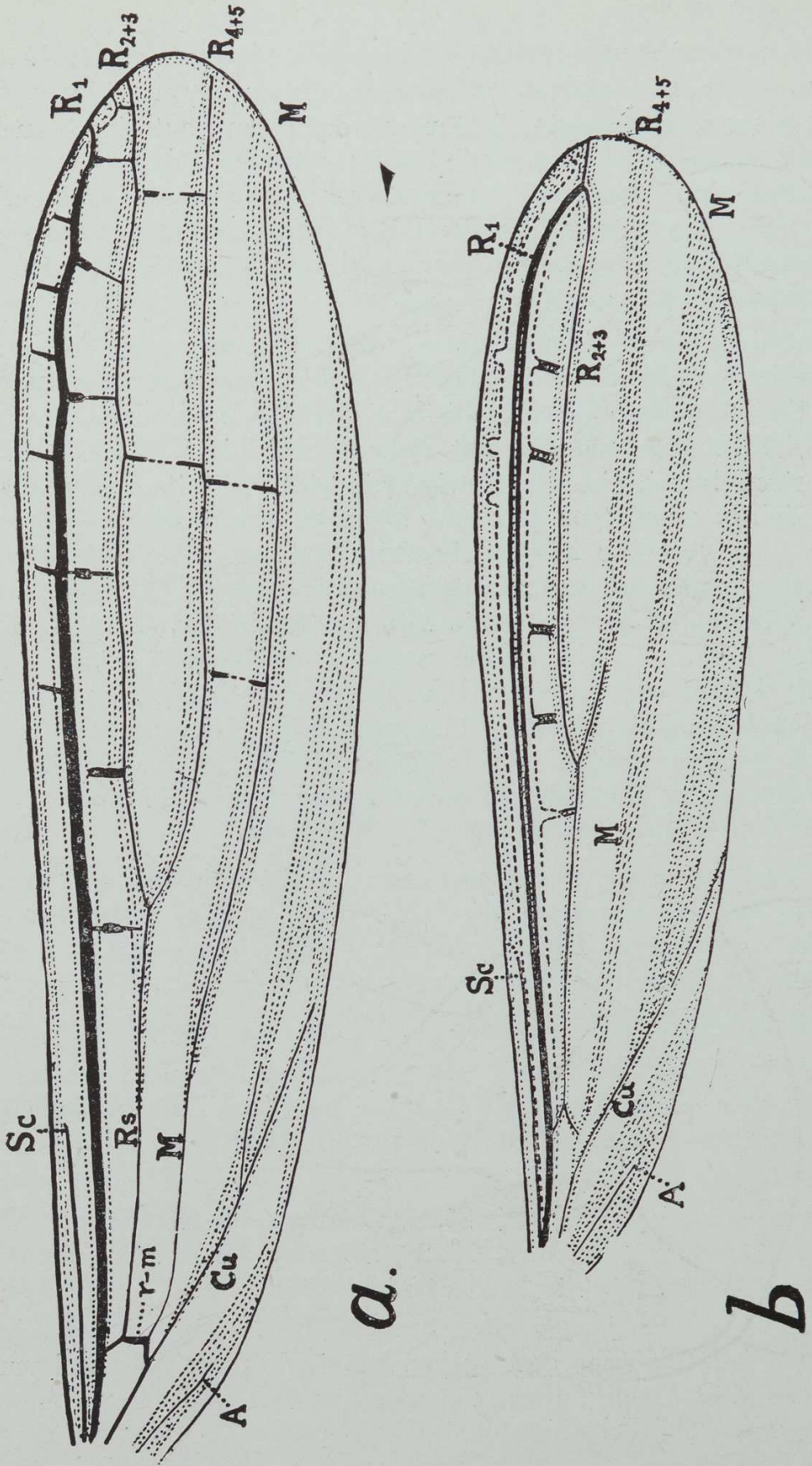
Habitat.—Milly Milly Station, Murchison River, lat. 26° S., long. 117° E.; 25th May, 1922, taken by Mr. L. Glauert. The insects were attracted to light at night time.

The above four specimens have all been mounted on slides in glycerin jelly, and the description was made from the specimens in this condition, except for the colouring, which is paler in the mounted specimens. The drawings of the appendages in Text-fig. 2, *b*, is taken from one of the two paratype males in the Cawthron Coll.

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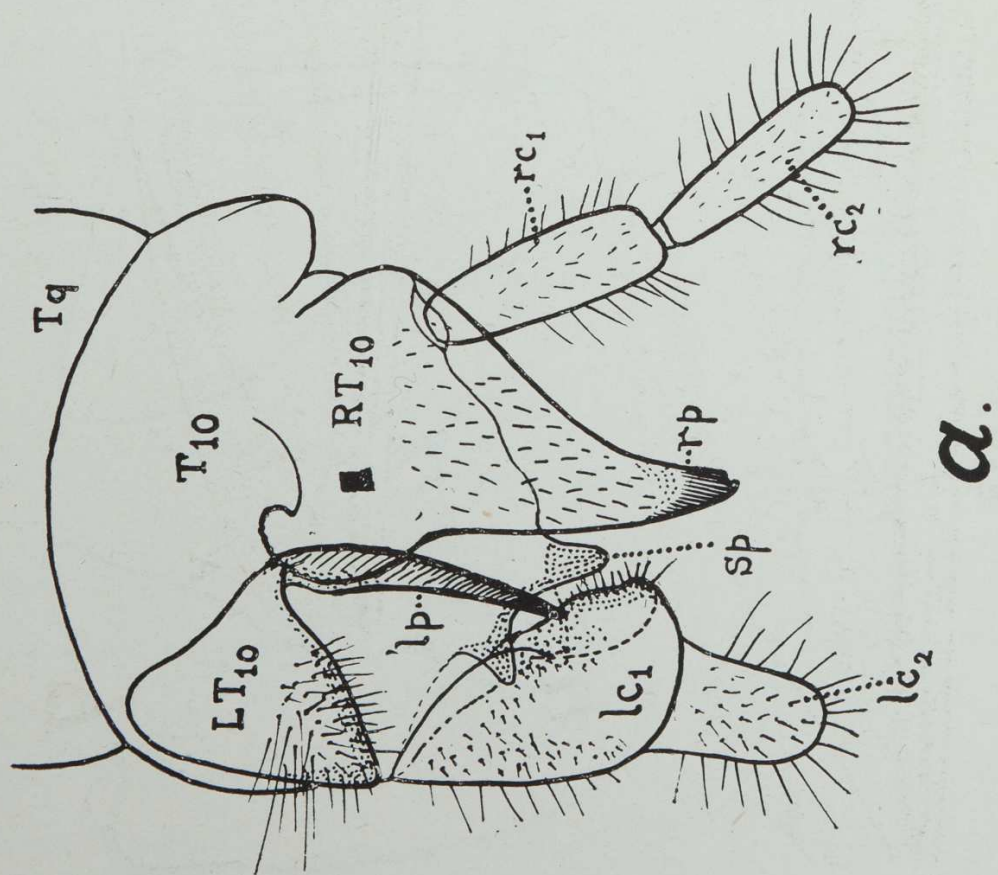
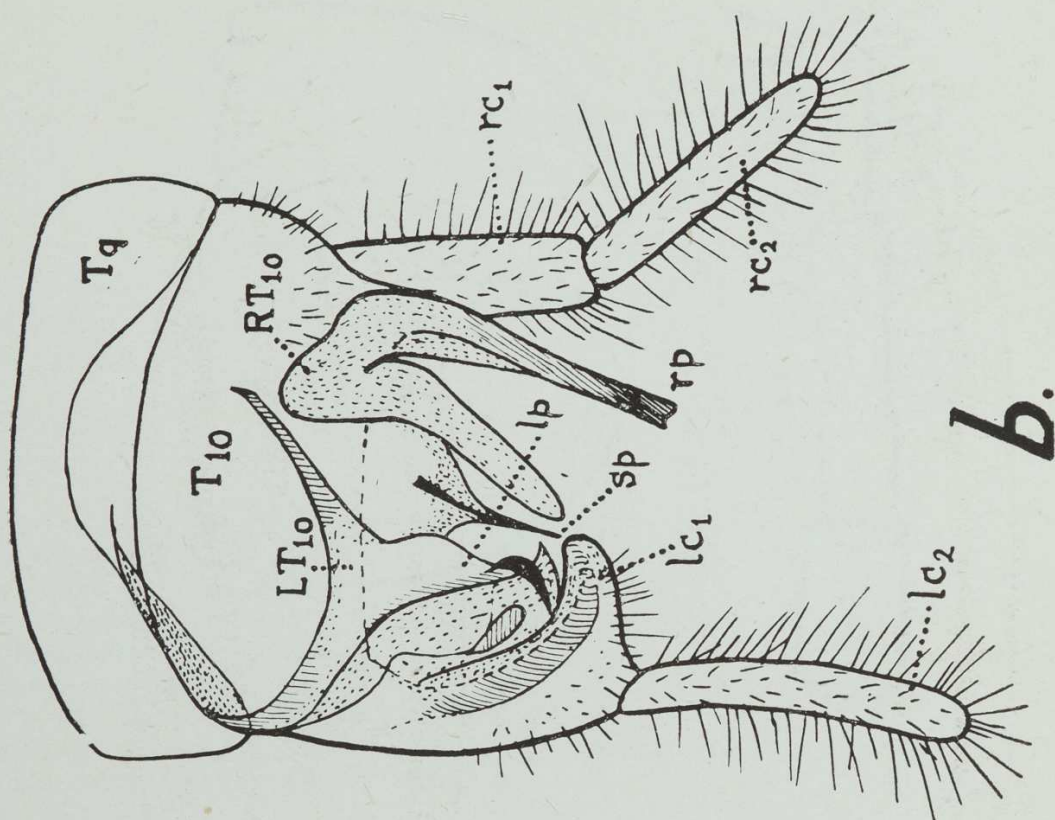
14th Nov., 1922.

Fig. 1.



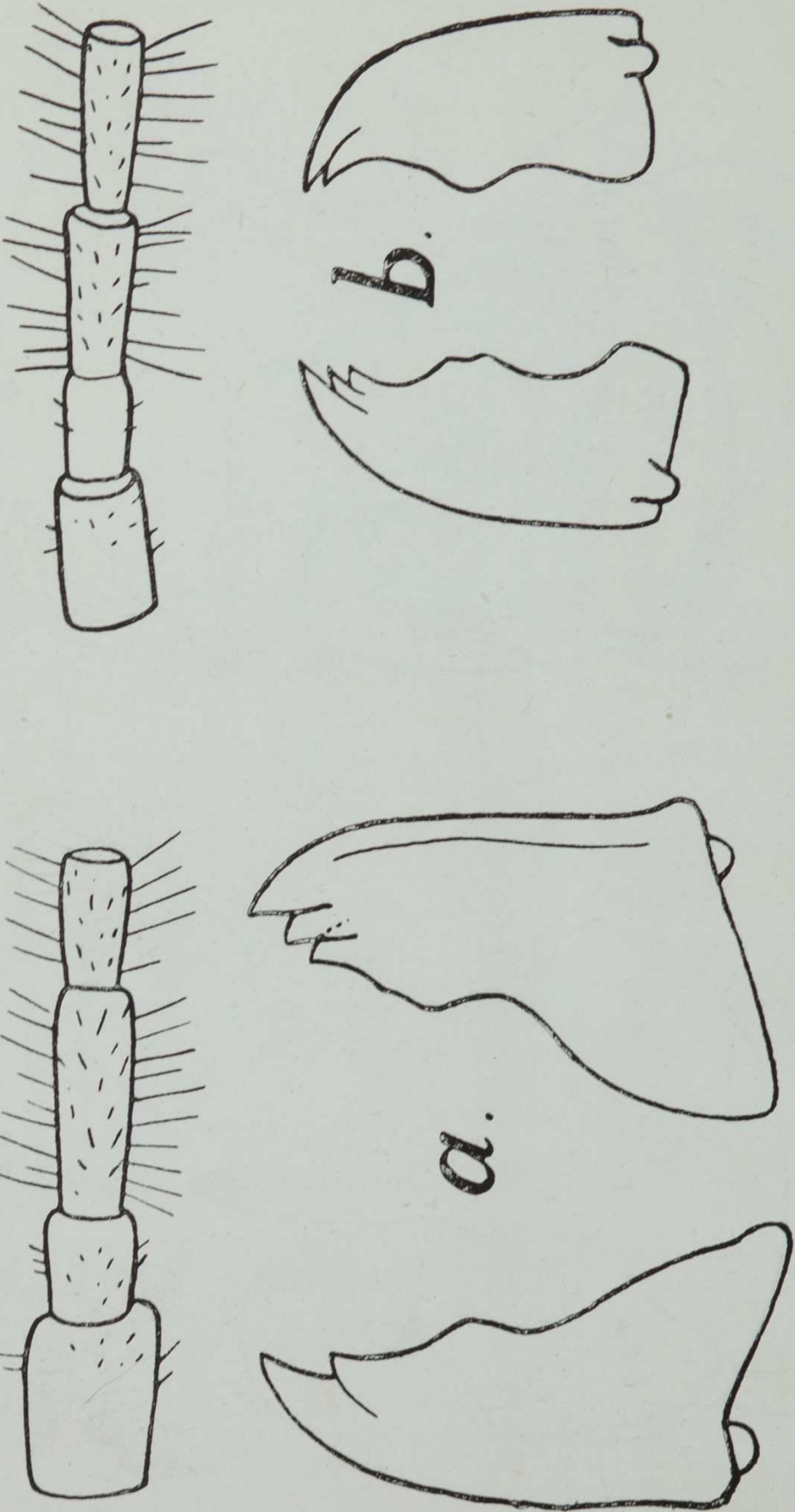
Text-fig. 1.—Forewing of *a*, *Oligotoma hardyi* Fried.; *b*, *Oligotoma glauerti* n. sp. A, anal vein; Cu, cubitus; M, media; R_1 , main stem of radius; Rs, radial sector, with its two branches R_{2+3} , and R_{4+5} ; *r-m*, radio-median cross-vein; Sc, subcasta. Macrotrichia omitted ($\times 9.6$).

Fig. 2.



Text-fig. 2.—Terminal abdominal appendages of male in *a*, *Oligotoma hardyi* Fried.; *b*, *Oligotoma glauerti* n. sp. lc_1 , lc_2 , first and second segments of left cercus; lp , process of left half of tenth tergite, LT_{10} ; rc_1 , rc_2 , rp , RT_{10} , same parts of right cercus and right half of tenth tergite; sp , process of ninth sternite (penis); T_9 , ninth tergite (x 36).

Fig. 3.



Text-fig. 3.—The two mandibles and first four segment of antenna in *a*, *Oligotoma hardyi* Fried., *b*, *Oligotoma glauerti* n. sp. (x 45).

(In *a* the mandibles were drawn from beneath, so that their positions are interchanged; the one with three teeth in the left mandible.)